DRUM COOKER

CROSS-REFERENCE OF PENDING APPLICATION

This application is a continuation of pending International Application PCT/EP99/00796 filed on Feb. 06, 1999.

BACKGROUND OF THE INVENTION

The present invention relates to a drum cooker for cooking granular products, especially corn grits for the production of cornflakes, having a vessel mounted to rotate about an axis with nozzles that open into the vessel and that are connected with lines through which a gaseous heat-carrying medium can be introduced into the vessel, there being provided at least two circumferentially distributed nozzles so that at least one nozzle opens into the area covered by the product while at least one nozzle opens into the area not covered by the product.

A drum cooker of this type is known, for example, under the designation DSCK from Gebr. Bühler AG, Uzwil, Switzerland.

A comparable drum cooker is also known from APV Baker, Peterborough, England, under the designation "Rotary cereal cooker".

The axis of the rotary vessel extends horizontally, the vessel as such has a substantially barrel-shaped contour. Inside the vessel, the product to be treated, for example corn grits, is mixed with water, the vessel being filled with that product-water mixture up to more than half its volume.

The heat supply is realized by nozzles arranged in the wall of the vessel, that are supplied with a hot gaseous medium, namely hot water steam, through lines extending along the outside of the vessel. The arrangement of the nozzles is such that the nozzle groups are located substantially diametrically opposite one to the other. All lines and/or nozzle groups are supplied form a common supply source via communicating lines. This means that the steam is supplied to all lines and all nozzles simultaneously.

In practical use it has, however, been found that the steam enters the interior of the vessel only through those nozzles that open into the area not covered by the product-water mixture at that time. These are the nozzles that occupy a position above the product-water mixture during the rotary movement.

Those nozzles that open into the area just covered by the product-water mixture hardly admit any steam since the counterpressure of the product-water mixture present in the vessel is so high as to prevent the steam from entering through those nozzles in any quantity worth mentioning.

This is due to the fact that the gas, being supplied simultaneously via all lines, tends to follow the line of least resistance, which is through the nozzles that are not immersed in the product-water mixture.

Even increasing the pressure does not cause the gas to enter through the nozzles in the area covered by the product.

This now leads to the effect that very poor heat transmission is achieved from the admitted heat-carrying medium to the product-water mixture revolving in the vessel, i.e. the mixture of water and the corn grits to be treated. The heat exchange occurs substantially at the surface of the product, which in revolving condition has a kidney-shaped cross-section, and the upper steam-filled space.

However, since it is necessary to continuously supply fresh heat-carrying medium for the cooking process, additional arrangements must be provided for carrying off the gaseous medium from the vessel, which is effected through openings arranged above the product-water mixture. This then creates the risk that fresh medium is carried off without a considerable heat exchange having taken place with the revolving product-water mixture.

This is connected with the considerable disadvantage that very long cooking times are necessary, with the risk that the starch shows gelatinizing phenomena in the outer areas of the corn grains, that have been cooked for a long time, while inside the grain the cooking process has not yet led to the desired result, so that a so-called "white spot" of uncooked starch is still left.

During further processing, this then leads to the result that after the grains have been rolled to flakes, these contain nongelatinized spots. The roasting process that follows then leads to cornflakes which exhibit pale discoloring in the area not thoroughly cooked (white spot), and which instead of containing the desired blisters, exhibit in this area a baked structure, i.e. a closed structure similar to puff pastry.

With respect to energy balance, this cooking process is extremely unfavorable.

It is, therefore, the object of the present invention to improve a drum cooker of the before-mentioned kind so that an efficient heat exchange and/or cooking process takes place that leads to reduced cooking times and by which, in addition, a good and uniform cooking result is achieved.

SUMMARY OF THE INVENTION

This object is achieved by the invention due to the fact that a control means is provided which ensures that the medium will be supplied at any time to those nozzles only that open into the area covered by the product.

This feature provides the advantage that the gaseous medium is now exclusively introduced through the nozzles that open into the area covered by the product, i.e. that are located below the water level so that the medium is blown directly into the water where it gets into intimate heat-exchanging relationship with both the water and the product to be treated.

This positive control results in much more purposeful, quicker and more effective heat transmission which leads to a uniform and excellent cooking result in considerably less time. The medium being introduced enters the product-water mixture to be heated through the nozzles in the form of uniformly distributed bubbles.

The purposeful introduction of the medium into the product-water mixture allows the vessel to be filled to a considerably higher level so that much more product can be treated with the same overall drum size. A voluminous pressure cushion, as required in equipment of the prior art, is now no longer necessary, the steam space serving exclusively venting purposes.

According to a further embodiment of the invention, the design of the control means is such that the vessel can be vented via those nozzles that open at any time into the area not covered by the product.

This features provides the additional considerable advantage that the heat-carrying medium is guided through the vessel very directly and uniformly, that it enters the product-water mixture directly, f lows through the mixture and is evacuated from the vessel through those nozzles which at that time are located above the product-water mixture level.

This permits the pressure build-up in the cooker to be adjusted in an easy way.

The nozzles, therefore, act as injection nozzles in the immersed condition and as venting nozzles when they are located above the water level.

According to a further embodiment of the invention, diametrically opposite nozzles are provided.

This feature, which is known as such, provides the advantage under control aspects that switching-over operations can be effected in a purposeful and simple way so that in a given angular area a nozzle works in the injection mode while in the next defined angular area it works in the venting mode.

According to a further embodiment of the invention, a plurality of nozzles are arranged along the axis of rotation of the vessel.

This feature provides the advantage, especially in the case of very large drum cookers, that the plurality of nozzles permit the heat-carrying medium to be injected at a plurality of positions so that especially uniform and quick heat distribution is guaranteed.

According to a still further embodiment of the invention, the control means comprises a multiple line distribution through which media are guided into and out of the vessel.

Multiple line distributions designed as stationary units for supplying a plurality of media separately into a rotating vessel, are commercially available (for example WEHBERG GmbH, Hagen, Germany) as complete compact units so that a simple and little complex control system can be realized.

Such a multiple line distribution allows not only the heat-carrying medium to be introduced and carried off, but also the water in which the corn grits are cooked and, if desired, even flavor agents and dulcifiants to be gradually added, for example. Additionally, line distributions for rinsing media may be provided so that after draining of the drum cooker a cleaning operation may also be carried out through the control means.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described and explained in more detail with reference to a selected exemplary embodiment in connection with the attached drawings, in which:

FIG. 1 shows a very diagrammatic view, partly sectioned, of a drum cooker;

FIG. 2 shows a representation of a corn grit to be treated;

FIG. 3 shows another processing step of such a grit, after it has been pressed between rollers;

FIG. 4 shows a finished cornflake, in the desired form; and

FIG. 5 shows a cornflake as it results from corn grit not uniformly cooked.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

A drum cooker shown in FIG. 1 is indicated generally by reference numeral **10**.

The drum cooker **10** comprises a horizontal, essentially barrelshaped vessel **12** that can rotate about a horizontal axis of rotation **13**.

The vessel **12** is rotatably seated in columns **16** and **18**, via lateral bearings **14**, **15**. The vessel is driven for rotary movement about an axis of rotation **13** via a chain drive **20** connected with a drive motor **22**.

A first line **24** is guided along a surface line on the outside of the vessel **12** and connects two nozzles **26** and **27** that open into the interior of the vessel **12**. Each nozzle **26**, **27** is provided with a filter **28**.

Diametrically opposite to that line and nozzle arrangement a further line is guided along the outside for supplying two nozzles **30** and **31**, likewise opening into the vessel **12**.

Both lines **24** and **29** end in a control means **32** provided with a multiple line distribution **34**.

The control means **32** is connected with a supply and control unit **40** through which the media and control operations, which will be described in more detail further below, are supplied and/or controlled.

The vessel **12** is provided with a lid, not shown, through which the product to be treated, for example corn grits, can be filled in and/or discharged.

Corn grits are corn grains from which the germs and shells have been removed.

In addition to the corn grits, water is filled into the vessel **12** up to a level considerably above the level of the axis of rotation **13**, as indicated in FIG. **1**.

For cooking the water and corn grit mixture contained in the vessel **12**, hot steam is introduced at approximately 120° C. and a pressure of approximately 1 to 2 bar.

According to the invention, the system is switched and/or controlled via the control means **32** in a manner such that the medium **35** is at any time introduced only through the line that supplies those nozzles that open into the area **33** covered by the product.

In the representation of FIG. **1**, it is the line **24** that supplies the nozzles **26** and **27**.

Thus, the medium **35** is introduced via the supply line **38**, the control means **32**, which for this purpose comprises a multiple line distribution, to the line **24** and from there to the nozzles **26** and **27**. The medium **35** then enters the product via the filters **28** in very finely distributed bubbles, as indicated in FIG. **1** by the flow arrows and the bubbles. This permits intimate, quick and uniform heat transmission from the medium **35** to the product-water mixture contained in the vessel **12**. Once the medium **35** has passed the mixture, i.e. left the liquid volume, it flows to the diametrically opposite nozzles **30** and **31** and can be discharged from the vessel **12** through the nozzles **30** and **31** and the line **29**. The line **29**, therefore, carries the medium through the multiple line distribution **34** to a venting opening **36**.

In the position illustrated in FIG. **1**, which corresponds to an instantaneous condition of the rotating drum cooker **10**, the nozzles **26** and **27** therefore work in an injection mode, while the nozzles **30** and **31** work in a venting mode. This situation is maintained so long as the nozzles **26** and **27** open into the area **33** covered by the product. Once the nozzles **26** and **27** have left that area, they are again switched to the venting mode; in the meantime, the nozzles **30** and **31** have reached the area **33** covered by the product and are switched over from the venting mode to the injection mode, which is effected automatically and under positive control by the multiple line distribution **34** of the control means **32**. It is thus possible to convert a granular product, for example the corn grits **42**, to the desired cooked state within short time.

Compared with the comparable prior art apparatuses of the kind described at the outset, i.e. of equal size and volume throughput, where the treating times are in the range of 120 to 150 minutes, a reduction of the treating time by 20 to 30% could be achieved. In addition to achieving a reduction in treating time, a perfectly cooked product was obtained already after that short treating time. Further, the charge can be increased by approximately 20% as compared with conventional drum cookers.